

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY


(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 03 APR 2006

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Applicant's or agent's file reference <b>PCT04-066-T</b>	<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. <b>PCT/JP2004/016911</b>	International filing date (day/month/year) <b>08.11.2004</b>	Priority date (day/month/year) <b>25.11.2003</b>	
International Patent Classification (IPC) or national classification and IPC <b>INV. H01M8/24</b>			
Applicant <b>TOYOTA JIDOSHA KABUSHIKI KAISHA et al.</b>			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of 7 sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 3 sheets, as follows: <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).			
4. This report contains indications relating to the following items: <input checked="" type="checkbox"/> Box No. I   Basis of the report <input type="checkbox"/> Box No. II   Priority <input type="checkbox"/> Box No. III   Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV   Lack of unity of invention <input checked="" type="checkbox"/> Box No. V   Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input checked="" type="checkbox"/> Box No. VI   Certain documents cited <input checked="" type="checkbox"/> Box No. VII   Certain defects in the international application <input type="checkbox"/> Box No. VIII   Certain observations on the international application			
Date of submission of the demand  <b>12.09.2005</b>	Date of completion of this report  <b>31.03.2006</b>		
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  <b>Koessler, J-L</b>  Telephone No. +49 89 2399-7217		



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/JP2004/016911

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

2-20	as originally filed
1	received on 12.09.2005 with letter of 09.09.2005

**Claims, Numbers**

1-17	received on 12.09.2005 with letter of 09.09.2005
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**Drawings, Sheets**

1/6-6/6	as originally filed
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- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-17
	No: Claims	
Inventive step (IS)	Yes: Claims	1-17
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-17
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VI Certain documents cited**

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1. Certain published documents (Rule 70.10)

and / or

2. Non-written disclosures (Rule 70.9)

**see separate sheet**

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**Box No. VII Certain defects in the international application**

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The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

**1. Cited documents**

Reference is made to the following documents:

- D1: US-B1-6 613 470 (SUGITA NARUTOSHI ET AL) 2 September 2003 (2003-09-02)
- D2: PATENT ABSTRACTS OF JAPAN vol. 011, no. 212 (E-522), 9 July 1987 (1987-07-09) & JP 62 031942 A (FURUKAWA ELECTRIC CO LTD:THE), 10 February 1987 (1987-02-10)
- D3: PATENT ABSTRACTS OF JAPAN vol. 012, no. 007 (E-571), 9 January 1988 (1988-01-09) & JP 62 165874 A (HITACHI LTD), 22 July 1987 (1987-07-22)
- D4: PATENT ABSTRACTS OF JAPAN vol. 010, no. 192 (E-417), 5 July 1986 (1986-07-05) & JP 61 039373 A (FUJI ELECTRIC CORP RES & DEV LTD), 25 February 1986 (1986-02-25)
- D5: PATENT ABSTRACTS OF JAPAN vol. 007, no. 226 (E-202), 7 October 1983 (1983-10-07) & JP 58 115772 A (TOKYO SHIBAURA DENKI KK), 9 July 1983 (1983-07-09)
- D6: US-A-5 547 777 (RICHARDS ET AL) 20 August 1996 (1996-08-20)
- D7: US-A-4 431 714 (MYERHOFF ET AL) 14 February 1984 (1984-02-14)
- D8: US-A-5 686 200 (BARTON ET AL) 11 November 1997 (1997-11-11)
- D9: EP-A2-1 445 815 (HONDA MOTOR CO., LTD) 11 August 2004 (2004-08-11)

**2. Amendments (Art. 34(2)b PCT)**

The amendment on p. 1 l. 11 consists in the correction of a clerical error.

New claim 1 is based on original claims 1 and 2 and on the description (p. 11 l. 8-10, 21, 22).

The dependancies of claims 3, 4, 16, 17 originally dependant on claims 1 or 2 have adapted adequately.

The amendments are acceptable under Art. 34(2)b PCT.

### **3. Novelty (Art. 33(2) PCT)**

The present application relates to a fuel cell stack comprising a plurality of multi-cell modules and a restraining member, which extends in the fuel cell stacking direction over all of the plurality of multi-cell modules, for restraining each of the plurality of multi-cell modules in a direction perpendicular to the fuel cell stacking direction at the opposite end fuel cells of each of the plurality of multi-cell modules.

D1 is no longer prejudicial to the novelty of new claims 1-17. D1 does not disclose a fuel cell comprising a plurality of multi-cell modules.

D2 is no longer prejudicial to the novelty of new claims 1-17. D2 does not disclose a restraining member which extends over all of the plurality of multi-cell modules.

D3 is no longer prejudicial to the novelty of claims 1-17. D3 does not disclose a restraining member restraining each of the plurality of multi-cell modules in a direction perpendicular to the fuel cell stacking direction.

D4 is no longer prejudicial to the novelty of claims 1-17. D4 does not disclose a restraining member restraining each of the plurality of multi-cell modules in a direction perpendicular to the fuel cell stacking direction.

D5 is no longer prejudicial to the novelty of claims 1-17. D5 does not disclose a restraining member which extends in the fuel cell stacking direction over all of the plurality of multi-cell modules, for restraining each of the plurality of multi-cell modules in a direction perpendicular to the fuel cell stacking direction.

D6 is no longer prejudicial to the novelty of claims 1-17. D6 does not disclose a restraining member for restraining each of the plurality of multi-cell.

D7 is no longer prejudicial to the novelty of claims 1-17. D7 does not disclose a restraining

member which extends in the fuel cell stacking direction over all of the plurality of multi-cell modules.

D8 is no longer prejudicial to the novelty of claims 1-17. D8 does not disclose a restraining member which extends in the fuel cell stacking direction over all of the plurality of multi-cell modules.

D9 (which is an intermediate document) is not prejudicial to the novelty of claims 1-17. D9 does not disclose a restraining member which extends in the fuel cell stacking direction over all of the plurality of multi-cell modules.

The present application meets the requirements of Art. 33(2) PCT.

#### **4. Inventive step (Art. 33(3) PCT)**

The closest prior art is considered to be represented by document D2.

The problem addressed in the present application is to be regarded as to provide an improved restraining of a fuel cell comprising a plurality of multi-cell modules.

None of cited documents taken alone or in combination would fairly suggest solution of the present application i.e. a restraining member which extends in the fuel cell stacking direction over all of the plurality of multi-cell modules, for restraining each of the plurality of multi-cell modules in a direction perpendicular to the fuel cell stacking direction at the opposite end fuel cells of each of the plurality of multi-cell modules.

The present application is considered to meet the requirements of Art. 33(3) PCT.

#### **5. Industrial applicability (Art. 33(4) PCT)**

The subject-matter of claims 1-17 is considered to be industrially applicable.

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

International application No.

**PCT/JP2004/016911**

**Re Item VI**

**Certain documents cited**

Certain published documents (R. 70.10 PCT)

Application No Patent No	Publication date (day/month/year)	Filing date (day/month/year)	Priority date ( <i>valid claim</i> ) (day/month/year)
EP1445815	11.08.2004	04.02.2004	04.02.2003

**Re Item VII**

**Certain defects in the international application**

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D2 is not mentioned in the description, nor is this document identified therein.

**DESCRIPTION**  
**FUEL CELL STACK**

**Field of Invention**

The present invention relates to a fuel cell. More particularly, the present invention relates to a fuel cell stack structure.

**Background of the Invention**

As illustrated in Japanese Patent Publication No. 2002-124291, and as illustrated in FIGS. 16 and 17, a fuel cell, for example, a Polymer Electrolyte Fuel Cell (PEFC) apparatus 10 includes a layering structure of a Membrane-Electrode Assembly (MEA) and a separator 18. The layering direction may be in any direction.

The MEA includes an electrolyte membrane 11 made from an ion exchange membrane and a pair of electrodes which includes an anode 14 disposed on one side of the electrolyte membrane and a cathode 15 disposed on the other side of the electrolyte membrane. A diffusion layer 13 may be disposed between the anode and the separator 18, and a diffusion layer 16 may be disposed between the cathode and the separator 18.

A first separator 18 disposed on one side of the MEA has a fuel gas passage 27 formed therein for supplying fuel gas (hydrogen) to the anode 14, and a second separator 18 disposed on the other side of the MEA has an oxidant gas passage 28 for supplying oxidant gas (oxygen, usually, air) to the cathode 17. The first and second separators 18 have a coolant passage 26 on opposite sides of the fuel gas passage 27 and the oxidant gas passage 28. In order to seal the fluid passages 26, 27 and 28 to each other, a rubber gasket 32 is disposed between adjacent fuel cells and an adhesive seal 33 is provided between the separators 18 disposed on opposite sides of the MEA of each fuel cell.

At least one (three at most) fuel cell 19 constructs a module. A number of modules are piled, and electrical terminals 20, electrical insulators 21, and end plates 22 are disposed at opposite end of the pile of modules to construct a stack of fuel cells (a fuel cell stack) 23. After tightening the stack of fuel cells between the end plates 22 in the fuel cell stacking direction, the end plates 22 are coupled to a fastening member 24 (for example, a tension plate) extending in the fuel cell stacking direction outside the pile of modules by bolts or nuts 25.



**CLAIMS:****1. (Amended) A fuel cell stack comprising:**

a plurality of multi-cell modules stacked in series, each of the plurality of multi-cell modules comprising a plurality of fuel cells layered in a fuel cell stacking direction and including opposite end fuel cells at opposite ends of the plurality of fuel cells layered; and

a restraining member, which extends in the fuel cell stacking direction over all of the plurality of multi-cell modules, for restraining each of the plurality of multi-cell modules in a direction perpendicular to the fuel cell stacking direction at the opposite end fuel cells of each of the plurality of multi-cell modules.

**2. (Cancelled)****3. (Amended) A fuel cell stack according to claim 1, further comprising:**

a connecting member for connecting adjacent multi-cell modules of the plurality of multi-cell modules to each other at opposing end fuel cells of the adjacent multi-cell modules.

**4. (Amended) A fuel cell stack according to claim 1, wherein each of the opposite end fuel cells of each of the plurality of multi-cell modules is a dummy fuel cell generating no electric power.**

**5. (Amended) A fuel cell stack according to claim 1, wherein each of the opposite end fuel cells of each of the plurality of multi-cell modules has an extended portion formed by extending each of the opposite end fuel cells of each of the plurality of multi-cell modules outwardly in a direction perpendicular to the fuel cell stacking direction of each of the plurality of multi-cell modules, and each of the plurality of multi-cell modules is restrained by the restraining member in the direction perpendicular to a fuel cell stacking direction of each of the plurality of multi-cell modules at the extended portion.**

**6. A fuel cell stack according to claim 5, wherein the extended portion includes a hole formed therein and the restraining member is a restraining shaft extending through the hole formed in the extended portion.**

**7. A fuel cell stack according to claim 6, wherein the restraining shaft is a fuel cell stack tightening shaft.**

**8. A fuel cell stack according to claim 3, wherein the connecting member is a member different from the restraining member.**

**9. A fuel cell stack according to claim 8, wherein the connecting member is a**

clip.

10. A fuel cell stack according to claim 8, wherein the connecting member is a member selected from the group composed of a bolt and a rivet.

11. A fuel cell stack according to claim 8, wherein each of the opposite end fuel cells of each of the plurality of multi-cell modules has an extended portion extended in a direction perpendicular to the fuel cell stacking direction of each of the plurality of multi-cell modules, and the connecting member is an ear portion formed in an extended portion of an end fuel cell of a first multi-cell module, the ear portion being bent so as to hold an extended portion of an end fuel cell of a second, adjacent multi-cell module.

12. A fuel cell stack according to claim 6, wherein the extended portion and the restraining shaft are electrically insulated from each other by an electric insulator.

13. A fuel cell stack according to claim 12, wherein the electric insulator is a bushing fixed to the hole formed in the extended portion of each of the opposite end fuel cells.

14. A fuel cell stack according to claim 13, wherein the bushing has a flange for preventing the bushing from being disengaged from the extended portion.

15. A fuel cell stack according to claim 12, wherein the electric insulator is a cylindrical member supported by the restraining shaft.

16. (Amended) A fuel cell stack according to claim 1, wherein each of the opposite end fuel cells of each of the plurality of multi-cell modules has an extended portion formed by extending each of the opposite end fuel cells of each of the plurality of multi-cell modules outwardly in a direction perpendicular to the fuel cell stacking direction of each of the plurality of multi-cell modules, and further comprising:

a deformation preventing member, disposed between extended portions of the opposite end fuel cells of each of the plurality of multi-cell modules, for preventing the extended portions of the opposite end fuel cells of each of the plurality of multi-cell modules from being deformed inboardly in the fuel cell stacking direction.

17. (Amended) A fuel cell stack according to claim 1, wherein the deformation preventing member includes an elastic or resilient member.